

*"When we build let us think we build forever.  
Let it not be for present delight nor for  
present use alone. Let it be such work that  
our descendants will thank us for, and let us  
think, as we lay stone upon stone, that a  
time is to come when these stones will be  
held sacred because our hands have  
touched them, and that men will say, as they  
look upon the labor and wrought substance  
of them, "See! This our fathers did for us."*

John Ruskin (1819 – 1900)

## 2014 Overseas Study Tour Chris Hastie

An assessment of what local governments in the United States, Canada and the United Kingdom are doing to prepare for the impacts of climate change on local infrastructure.



Municipal  
Engineering  
Foundation Victoria

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## Preface

As they say, “the science is in” on climate change. Climate change is occurring, in some instances very slowly and incremental, in others with significant or disastrous consequences. Of course, for many communities climate adaptation is considered a normal part of life. The challenge now is to be able to predict what changes will come into the future and to assess, with some level of confidence, what strategies will be used to respond to these changes. If responding to these changes relies on changes to existing infrastructure, our forward infrastructure planning frameworks should take these changes into consideration. Whatever approach is chosen, it should be done in planned, considered and sustainable way.

According to the Intergovernmental Panel on Climate Change (IPCC), communities around the world may expect to have to adapt to some of the following -

- Warmer days, fewer cold days and nights, and more frequent hot days and nights over most land areas;
- Increased frequency of warm spells/heat waves over most land areas
- Increased frequency of heavy precipitation events over most areas
- Increased area affected by drought
- Increased intense storm and tropical cyclone activity
- Increased incidence of extreme high sea level

As part of its annual awards program the Municipal Engineering Foundation Victoria sponsored five participants to undertake the 2014 overseas study tour. The 2014 tour allowed participants the opportunity to visit a range of organisations throughout the United States, Canada and the United Kingdom to research their respective topics. The topics chosen by the participants cover a range of areas relating to the planning and development of local government infrastructure.

In addition to me, other participants in the 2014 study tour and their respective areas of research are;

Rick Kwasek, Manager Public Spaces and Capital Works, Stonnington City Council  
Unpacking Success in Project Management to provide an international perspective on Local Government project delivery

Alison Leighton, Director of Sustainable Infrastructure, Mornington Peninsula Shire Council  
Innovations in Funding & Evaluating Municipal Public Works Programs

Ebony Perrin, Environmental Services Team Leader, Moyne Shire Council  
Climate Change Adaptation Projects in Coastal Management and Planning

Daniel Przychodzki, Team Leader Transport, City of Greater Dandenong  
Providing Sustainable and Active Transport Options in Established Areas

As well as attending the 2014 APWA congress in Toronto, the group visited a range of organisations over 5 cities throughout the USA, Canada and the United Kingdom to research and support their specific areas of study. The tour took over three and a half weeks. Appendix 1 gives some further specific detail in relation to the sites visited.



## USA

- San Francisco - San Francisco Public Utilities Commission (SFPUC), County of San Mateo, Alameda County Public Works Agency, San Francisco Municipal Transport Authority,
- Miami - Miami-Dade County – Public Works / Office of Sustainability / Environmental Resource Management / Parks and Recreation, City of Miami Beach
- New York - City of Newark - Brick City Development Corporation, New York City - Department of Transport / Department of Environmental Protection

## Canada

- Toronto - Region of Halton, City of Burlington, City of Toronto, Thales

## United Kingdom

- England - City of London, Greater London Authority, Transport for London, Swindon Borough Council



## Acknowledgments

I wish to thank the Municipal Engineering Foundation for providing me the opportunity to participate in the 2014 Study Tour.

Of course there are a number of people who I would also like to thank for being a part of or supporting me through this time and while on the tour.

I thank the Wellington Shire for providing me the time and support for the study tour.

I particularly thank my wife and children whose support enabled me to undertake the tour.

I would like to thank all of the tour hosts. In many instances our hosts went above and beyond and I can't thank them enough for their time and willingness to meet and discuss the various study topics. Without their involvement there is no study tour.

Finally, I would like to thank my fellow awardees and our tour mentor Claudio Cullino. It was pleasure to share this experience with them.





## Executive Summary

The impact of a changing climate on the world and its communities is one of the greatest challenges of our era. This report aims to provide some insight into climate change trends and responses at a number of sites through the United States, Canada and the United Kingdom, and also to provide some observation on how these responses might apply locally.

Observations at each site visited focused on six key areas of interest in climate change adaptation planning and are aimed at providing some focus around leadership, impacts, processes, resourcing, and community engagement and success.

The report aligns with the countries visited so as to give some federal / state context and to set the scene for some regional/local observations. By doing this it provides a more succinct and readable report particularly when drawing conclusions and recommendations.

Many of the organisations visited were Coastal, and as you would expect, their main focus in relation to climate change related to sea level rise. Beyond this, organisations were focused mainly on changes in rainfall patterns and extreme weather events.

During the tour, there were many excellent examples of highly effective partnerships between municipalities. The standout was the South East Florida Climate Change Compact. The Compact was initiated at the highest levels of the organisations that formed the Compact; it is well resourced, and has buy-in from each of the partners within the Compact. It is an excellent example of how important good leadership is to climate change adaptation planning.

Each municipality visited showed how critical data is to be able show communities how global predictions translate into to local impacts. There were a number of good examples of data gathering and presentation shown during our visits, a number of which are presented in this report.

Many municipalities visited had developed robust climate change adaptation processes. Processes generally accounted for key themes including data gathering, impact analysis, risk assessment and engagement although varied slightly on how they were presented. At the core of each process was a risk assessment and action prioritisation procedure which will be critical to effective climate adaptation planning.

Even though many of the municipalities visited were quite large, they are challenged with the same issues when it comes to resourcing and funding climate change adaptation actions, albeit on a larger scale.

It is critical to involve the community from the beginning of the planning process. During our tour, it was clear that those who have involved the community early are progressing well with their planning process.

The effects of climate change pose significant risks for local authorities. Climate change will result in more frequent and more intense rainfall and weather events, increased temperatures, and increased sea levels amongst others. This will cost billions of dollars in recovery and restoration costs associated with extreme events. These impacts have the potential to be hugely disruptive to how local governments operate. A number of recommendations are provided at the end of this report which may assist local authorities who are beginning the process of climate change adaptation.

Infrastructure investment decisions have enormous impacts on our vulnerability to climate change and the costs of climate impacts. By adjusting our thinking, decisions and actions in response to observed or predicted changes in climate, we will be able to better plan and implement optimal outcomes for the greater benefit of all concerned.



## 1. Introduction

My specific area of interest and my study topic relates to planning for climate change adaptation. Being the third largest municipality in Victoria, with a total area just under 11,000 square kilometers, the Wellington Shire Council lies at the heart of Gippsland.

Wellington reaches from the high country to one of the longest beaches in the world. The ninety mile beach. More than 41,000 residents live in Wellington Shire spread across more than thirty diverse communities, including the townships of Sale, Maffra, Rosedale, Stratford, Heyfield and Yarram.

As a rural/regional council Wellington continues to face the challenge of balancing the expectations of these diverse communities with regard to infrastructure and services against available funding.

As it is with many municipalities, a significant challenge for Wellington is the effective and efficient long term planning of our infrastructure assets. With an infrastructure replacement value exceeding \$800M, it is important that long term planning takes account of external influences where possible.

While some research has been performed in relation to potential impacts of climate change within the Wellington Shire, it has been focused particularly on land use planning and development and understanding social impact and expectations.

Indications are that before the end of this century, up to 775km of the Wellington road network has the potential to be impacted by inundation or shoreline recession. In addition, the potential impact on other council and non-council infrastructure, including stormwater, property and open space is likely to be significant, whether directly by coastal inundation/ recession, increased rainfall or changed climatic conditions. At this stage little work has been done that specifically focuses on this impact, particularly as it relates to long term asset planning and development, and delivery of public works.

My area of research focuses on what strategies/methodologies are being used overseas to understand and prepare for these infrastructure impacts/needs and how it might be applied to Wellington Shire Council and other Victorian municipalities.

Given that the subject of climate change is far reaching, I have constrained my report to focusing on what would generally be considered as Victorian local government infrastructure. I have also not considered to any great detail mitigation of climate change in my report.

In preparing to research my study topic, I provided our host organisations with the following questions to guide them in providing feedback during our visits. The questions specifically relate to some of the key areas of interest in climate change adaptation planning and are aimed at providing some focus around leadership, impacts, processes, resourcing, and community engagement and success.

- **Climate Adaptation Leadership** Are roles and responsibilities for climate adaptation planning clearly defined between levels of government and within your organisation? How important is climate change adaptation planning to your organisation?
- **Climate Change Impacts** What processes do you use to determine the impacts of climate change on your organisations infrastructure? Who do you inform about these impacts?



- **Adaptation Planning Processes** What processes do you use to move from understanding and informing about these impacts on your infrastructure to planning to adapt to them? How long term are your adaptation plans and what factors are considered in prioritising your initiatives/actions?
- **Resourcing / funding your climate change adaptation initiatives** What is your organisation doing to resource / fund your climate change adaptation initiatives/actions? Is this resourcing / funding supported by other levels of government or your community and if so how and to what extent?
- **Community engagement** How do you engage with your community and other stakeholders in your climate change adaptation planning process?
- **Measuring success** Do you have any examples of where your climate change adaptation planning has worked well, and where it has not worked well? How do you/will you measure the success, or otherwise, of your climate adaptation plan?

I have separated my report into areas that align with the countries visited so as to give some federal / state context and to enable me to drill down into some regional/local observations. By doing this I aim to allow a more succinct and readable report particularly in refining my conclusions and recommendations.



## 2. Overview and Observations of sites visited United States of America (US)

### 2.1 San Francisco, California, US

#### Overview

The United States has Federal, State and Local Government with a number of tiers within the local government framework.

County Councils are generally responsible for a range of services including law enforcement, fire protection, jails, tax collection, libraries, main roads etc. and are often geographically aligned with cities in their area and in some instances consolidated with cities to form one entity with the governmental powers of both entities.

Property tax is collected by Counties and a portion distributed to the Cities within the County. Other income may be derived from utility taxes and sales taxes, with sales tax usually being the largest revenue source. A portion of the sales taxes collected by State Government is also distributed to Local Government.

Both Counties and Incorporated Municipalities have a number of elected and appointed officials depending on their specific circumstances. Most Counties elect their supervisors by district, and have an appointed County Administrative Officer. Similar to Australia, Incorporated Municipalities generally have an elected Council that appoints a city manager to supervise operations of the city.

Across the United States, climate change is affecting many communities. The United States government has responded in recent years through the development of a number of broad ranging strategies to prepare for and adapt to effects of climate change at a national level. Many federal agencies have developed specific programs to support adaptation at the federal, state and local government levels. Actions have then been developed by these agencies to support implementation of these strategies. The US EPA website, for instance, provides easy access to the various strategies developed by these agencies including plans specific to major regional areas of the US.

For example, the U.S. Department of Transportation (DOT) has developed a Transportation and Climate Change Clearinghouse with information about the effects of transportation on climate change, as well as the impacts of climate change on transportation. The Adaptation Planning section provides resources about approaches to planning for potential impacts caused by climate change.

In California, many state and local governments are already preparing for the adaptation to the impacts of climate change. The Californian State government has highlighted that climate change is expected to have significant and widespread impacts on California's economy and environment.

California is divided into 58 Counties. Counties also act as local government for unincorporated areas not incorporated with any city. There are 58 Counties in California. In addition to these Counties, there are approximately 480 incorporated municipalities (cities/towns) within California. Incorporated cities and towns have the power to levy taxes. Specific to their area, they may also take on some of the services provided by the County, such as land zoning, building permits, maintaining public streets and parks, public housing, and various utility services.

In recent years the Californian State Government has responded to the threat of climate change in a number of ways, including the California Global Warming Solutions Act of 2006, the California





Climate Adaptation Strategy, and are currently developing an Adaptation Planning Guide to provide a decision-making framework intended for use by local and regional stakeholders. This guide is aimed at assisting in the interpretation of climate science and to develop a systematic rationale for reducing risks caused, or exacerbated, by climate change.

In addition to this work, the California Natural Resources Agency and the California Energy Commission have released Cal-Adapt, a web-based tool which enables city and county planners, government agencies, and the public to identify potential climate change risks in specific areas throughout California.

Observations

California has a high level of engagement and support between the various tiers of government in relation to adaptation planning. The various organisations visited demonstrated a high level of understanding and commitment to comprehensive adaptation planning.

Good leadership and support from the top was a critical component of adaptation planning for each of the organisations visited. At the San Francisco Public Utilities Commission (SFPUC) the Mayor directed that an inter-departmental task force, referred to as SF Adapt, be formed to assess the potential impacts of climate change on the City. As a first step, an inter-departmental Sea Level Rise Committee was formed. That committee has developed a document called “Draft Guidance for Incorporating Sea Level Rise into Capital Planning in San Francisco. The draft SLR Guidance is intended to be a “how to” guide for capital planners and presents the most up-to-date science on SLR and lays out four steps in the process for incorporating SLR into capital planning: 1) science review; 2) vulnerability assessment; 3) risk assessment; and 4) adaptation planning. According to our hosts, the direction and support of the Mayor was key to the successful development of this document.

In a general sense, each organisation visited has a process for understanding and assessing climate data, asset inventories, climate impacts, vulnerability and risk assessment and adaptation strategies. The focus of our conversations were around the most at risk assets and services identified during their respective climate vulnerability and risk assessments.

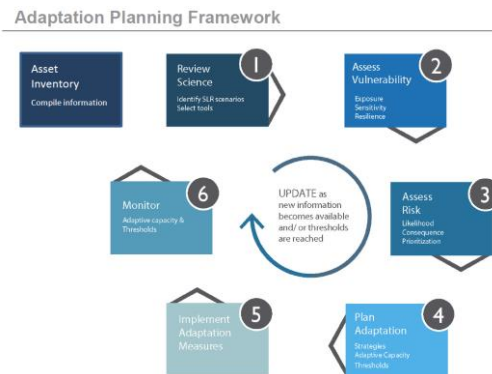
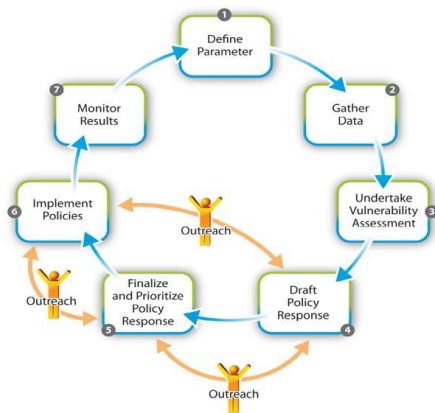
Climate impacts similarly seem to be well researched and understood and are utilized to assess vulnerability across the various sectors, whether in relation to utilities at SFPUC or public infrastructure at each of the Counties visited. Focus in the San Francisco bay area, supported by the state government with the “San Francisco Bay Plan”, is related heavily to the impacts of SLR and storm impacts as the major source of risk over the coming decades. The two tables below indicates the level of historic and predictive data available to these organisations to assist with their forward planning for these impacts.

| Station                  | Years of Record      | Sea Level Rise Rate  |
|--------------------------|----------------------|----------------------|
| San Diego                | 1906-present 104 yrs | 2.06 +/- 0.20 mm/yr  |
| La Jolla                 | 1924-present 86 yrs  | 2.07 +/- 0.29 mm/yr  |
| Newport Beach            | 1955-1995 40 yrs     | 2.22 +/- 1.04 mm/yr  |
| Los Angeles              | 1923-present 87 yrs  | 0.83 +/- 0.27 mm/yr  |
| Santa Monica             | 1933-present 77 yrs  | 1.46 +/- 0.40 mm/yr  |
| Rincon Island            | 1962-1990 28 yrs     | 3.22 +/- 1.66 mm/yr  |
| Santa Barbara            | 1973-present 15 yrs  | 1.25 +/- 1.82 mm/yr  |
| Port San Luis            | 1945-present 65 yrs  | 0.79 +/- 0.48 mm/yr  |
| Monterey                 | 1973-present 47 yrs  | 1.34 +/- 1.35 mm/yr  |
| San Francisco            | 1857-present 153 yrs | 2.01 +/- 0.21 mm/yr  |
| Alameda                  | 1939-present 71 yrs  | 0.82 +/- 0.51 mm/yr  |
| Point Reyes              | 1975-present 35 yrs  | 2.10 +/- 1.52 mm/yr  |
| North Spit, Humboldt Bay | 1977-present 33 yrs  | 4.72 +/- 1.58 mm/yr  |
| Crescent City            | 1933-present 77 yrs  | -0.65 +/- 0.36 mm/yr |

| Sea Level Rise | Water Level above MHHW | Extreme Tide (Storm Surge) Levels |      |      |       |       |       |        |  |
|----------------|------------------------|-----------------------------------|------|------|-------|-------|-------|--------|--|
|                |                        | 1-yr                              | 2-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |  |
| 0"             | 0                      | 12                                | 19   | 23   | 27    | 32    | 36    | 41     |  |
| +6"            | 6                      | 18                                | 25   | 29   | 33    | 38    | 42    | 47     |  |
| +12"           | 12                     | 24                                | 31   | 35   | 39    | 44    | 48    | 53     |  |
| +18"           | 18                     | 30                                | 37   | 41   | 45    | 50    | 54    | 59     |  |
| +24"           | 24                     | 36                                | 43   | 47   | 51    | 56    | 60    | 65     |  |
| +30"           | 30                     | 42                                | 49   | 53   | 57    | 62    | 66    | 71     |  |
| +36"           | 36                     | 48                                | 55   | 59   | 63    | 68    | 72    | 77     |  |
| +42"           | 42                     | 54                                | 61   | 65   | 69    | 74    | 78    | 83     |  |
| +48"           | 48                     | 60                                | 67   | 71   | 75    | 80    | 84    | 89     |  |
| +54"           | 54                     | 66                                | 73   | 77   | 81    | 86    | 90    | 95     |  |
| +60"           | 60                     | 72                                | 79   | 83   | 87    | 92    | 96    | 101    |  |
| +66"           | 66                     | 78                                | 85   | 89   | 93    | 98    | 102   | 107    |  |



Similar to other organisations visited in California, the County of San Mateo has developed a comprehensive Climate Action Plan. Their plan focuses primarily on mitigation although devotes a section to adaptation planning. This plan includes some practical steps that can be used by other organisations when planning for adaptation including the following adaptation planning frameworks -



Climate Adaptation Plans presented provide clarity relating to design and operational strategies, managing climate related risks, and identify trigger points for implementing adaptation strategies to improve outcomes for the future, however on the whole, for the organisations visited in the San Francisco region, this focus was clearly on Sea Level Rise. The following figures give an indication of the level of information available at each organisation in relation to predicted vulnerability from sea level rise.



To varying degrees, each organisation relies on traditional funding models to support infrastructure planning and delivery. While some of these models vary from Australian conditions, between bonds/loans/grants or direct revenue etc., adaptation plans will need to be financially resourced by the most appropriate method depending on the complexity of the action and the timeframe for implementation. The commitment of staff resources towards planning for climate change adaption was quite high on the most part, however given the relative size of each of the organisation, this was not surprising. This commitment of staff towards climate change planning has clearly assisted each organisation to progress planning forward as much as they have over the past decade. For instance at SFPUC there was two dedicated positions that focus on climate change.

Similarly, engagement with the community with regard to climate change, while a key component of each organisations process, varies. For instance, SFPUC has a division dedicated to community engagement.

Generally traditional engagement techniques were used although there were some innovative techniques used as part of SFPUC's engagement program such as interactive planning games, eNewsletters, and direct engagement through social media. Climate change is woven into all of its



“outreach” efforts, particularly as climate change represents one of the SFPUC’s endorsed goals of “Modify the System to Adapt to Climate Change”.

In terms of measuring the success of adaptation planning, organisations also highlighted that success can come in many forms. They indicated that City and County departments are coordinating to develop a consistent scientific basis and assessment framework for evaluating climate change risks and development of adaptation strategies.

For instance, the detailed SLR inundation maps prepared by SFPUC provide complete coverage of the city, and these documents can be leveraged and used by other departments in their planning efforts. At SFPUC, they count this level of coordination and collaboration as a measure of success in relation to adaptation planning.



## 2.2 Miami, Florida, US

### Overview

Much of Florida is a peninsula between the Gulf of Mexico, the Atlantic Ocean, and the Straits of Florida. Florida has the longest coastline in the contiguous United States, encompassing around 2,170 km. As you would expect, much of the state is at or near sea level. The climate is essentially tropical. All told, there are 67 counties in Florida. The total population is in excess of 18 million. Miami-Dade County, one of the organisations visited is the most populous at over 2.5 million people.

There are four types of local government entities: counties, municipalities, school districts, and special districts. Municipalities can be called towns, cities, or villages. Similar to California municipalities often have police departments, fire departments, and provide essential services such as water, waste collection, etc. In unincorporated areas of a county, the county itself can also provide some of these services. Municipalities may also enter agreements with the county to have the county provide certain services.

In Florida, both counties and cities can have a legislative branch (commissions or councils) and executive branch (mayor or manager). Counties and municipalities are authorised to pass laws, levy taxes, and provide public services. All municipalities are located within a county and the county jurisdiction overlays the municipal jurisdiction.

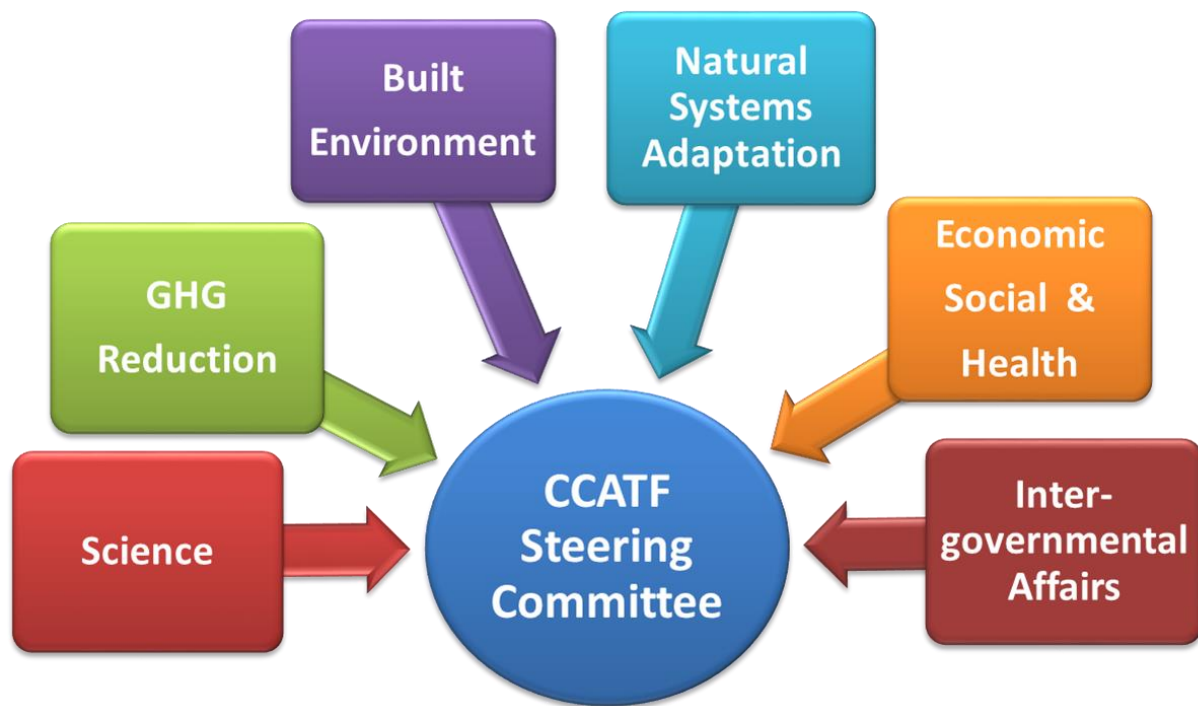
In 2007, the then Governor established the Florida Governor's Action Team on Energy and Climate Change and directed it to create a comprehensive Energy and Climate Change Action Plan under executive order. The executive order directed that the preparation of the action plan be "guided by an evaluation of the possible consequences to Florida's energy, economy, and society from global climate change," and that it occur in two phases. Phase one focused primarily on strategies to reduce greenhouse gas emissions, while Phase two focused on long-term strategies related to reducing climate impacts to society, public health, the economy, and the natural environment, and on developing industry and the economy to help combat climate change. The Energy and Climate Change Action Plan was released in 2008. Importantly for that time, the plan not only included a number of policy recommendations, part of the plan details adaptation strategies for improving Florida's resilience to the anticipated impacts of climate change, as well as a planning framework for adaptation. It also discusses the climate change impacts projected for Florida, including temperature changes, precipitation changes, sea-level rise, and extreme weather.

### Observations

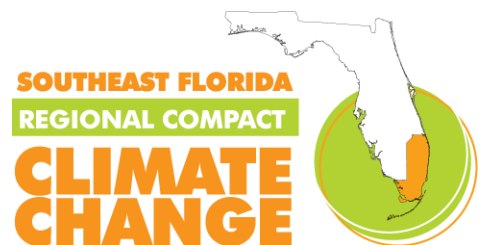
As indicated during our visit to Miami Dade County (MDC), there is strong leadership across the tiers of government relating to climate change adaptation planning in Miami. In 2006 the Board of County Commissioners appointed the Miami Dade Climate Change Adaptation Task Force (CCATF) to recommend actions in relation to Climate Change. A number of these actions are currently being implemented.





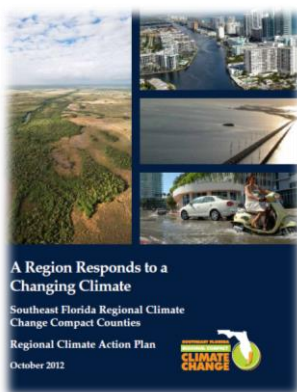


Representatives of four South East Florida County Commissions came together at the 2009 Southeast Florida Regional Climate Leadership Summit. The representative discussed regional challenges and threats from global climate change on the 5.9 million residents of this region, and a call to action for regionalized efforts was issued in the form of the Southeast Florida Regional Climate Change Compact (SFRCCC).

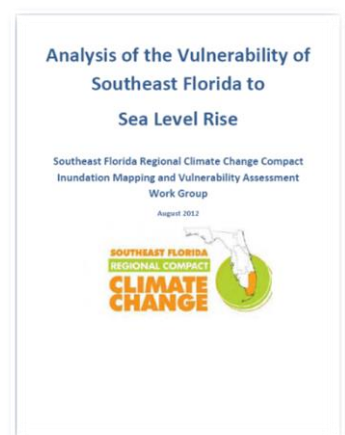


The Compact is an agreement adopted by the Broward, Miami-Dade, Monroe and Palm Beach County Commissions in January 2010. The counties recognized the vulnerability of the Southeast Florida region to the impacts of climate change and resolved to work collaboratively on mitigation and adaptation strategies such as joint policies to influence climate/energy legislation and funding at state and federal levels, developing a Regional Climate Change Action Plan, and hosting annual summits to review progress and discuss strategies.

The Compact formed a Staff Steering Committee with representatives from each of the Compact Counties and the 109 cities of the region, as well as ex-officio advice from regional entities such as the South Florida Water Management District, South Florida Regional Planning Council, and others.



The Southeast Florida Regional Climate Action Plan (RCAP) was developed in 2012 with 110 action items aimed at reducing greenhouse gas emissions and adapting to the effects of climate change. Ongoing workshops to aid in the implementation of the RCAP's action items began in 2013.

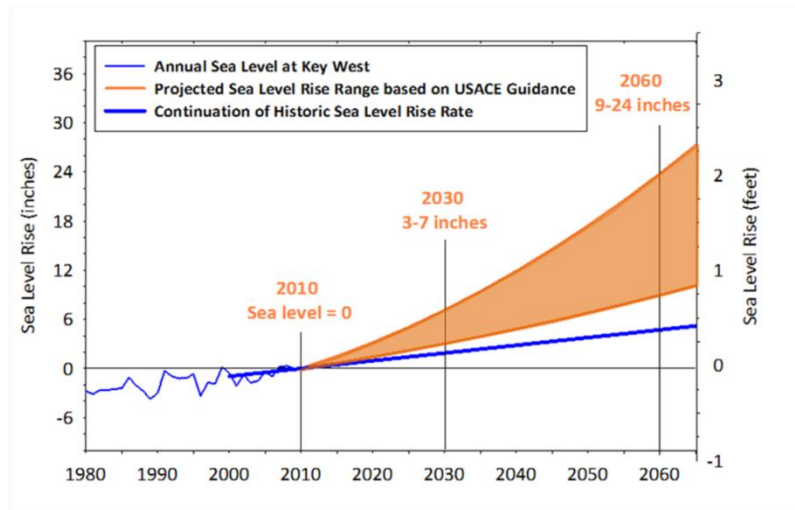


City of Miami Beach, one of our hosts is the municipal representative for Miami-Dade County on compact

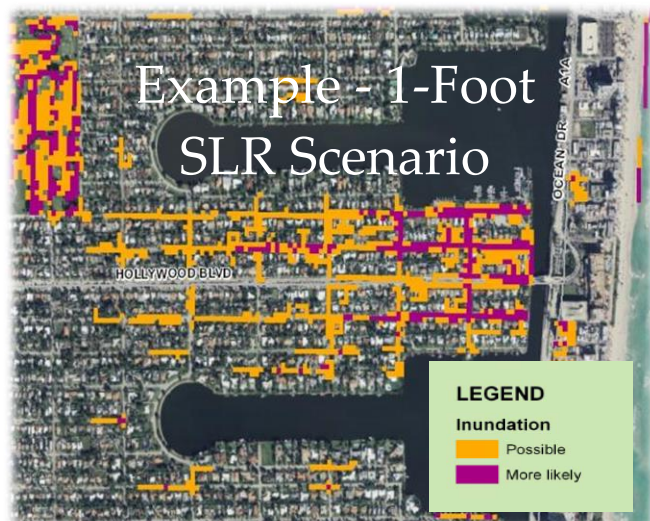
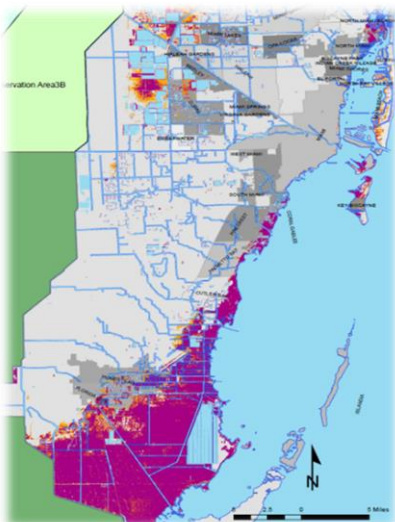
The four counties of the South East Florida Regional Climate Change Compact brought together a group of local SLR experts to develop a SLR projection for the region. This was a collaborative process and included individuals from Broward and Miami-Dade CCATFs, scientists from regional universities, staff from South Florida Water Management District, and scientists from the National Oceanic and Atmospheric Administration.

Miami is ranked number 1 in the list of top 20 cities in terms of assets exposed to coastal flooding by 2080. ("Ranking of the World's Cities Most Exposed to Coastal Flooding Today and in the Future" – Organisation for Economic Co-operation and Development et al.)

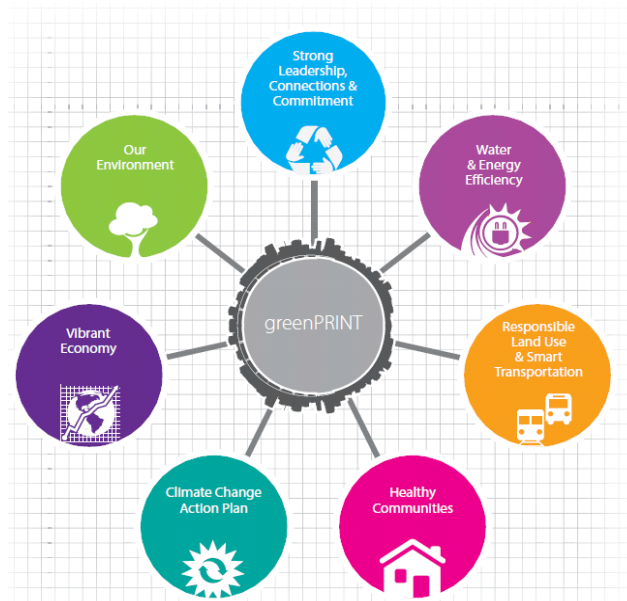
The chart below shows historical SLR data and future predictions of SLR. The blue line on the left shows part of the long term record from Key West. Over the last 100 years, sea level has risen 8-10 inches. If that trend continued, 5 inches of sea level rise would be expected by mid-century. Predictions are however that Miami will experience an acceleration in SLR during this century, expecting 3-7 inches of SLR from today's levels by 2030 and up to 2 feet of SLR in the next 50 years.



In addition to this data, the SFRCCC has also produced spatial mapping information that indicates areas impacted by SLR in South East Florida as indicated below.



GreenPrint lays out MDC’s vision and action plan for a greener, more sustainable future. The plan’s development was a collaboration between county staff, community groups/residents, experts from the business community and academia. During the course of a year, nearly 100 public meetings were held. GreenPrint culminates in MDC’s first Climate Action Plan. There are 137 separate initiatives outlined in GreenPrint.



MDC developed the following process to assist with adaptation planning. Again it appears to be a practical risk based assessment and action development process for climate change adaptation.



In supporting its actions, Florida has legislation that allows local governments to designate Adaptation Action Areas for the purpose of identifying areas of SLR/Coastal flooding concern and prioritizing funding for adaptation.





## 2.3 New York, New York, US

### Overview

The state of New York is the third-most populous in the US. The state has an international border with the Canadian provinces of Quebec and Ontario to the west and north.

New York City, with an estimated population of over 8.4 million is the most populous city in the United States. The city is the main gateway for legal immigration to the United States. The New York City metropolitan area is one of the most populous urban clusters in the world

New York City interestingly is the also the home of the United Nations Headquarters and is often described as the financial capital of the world.

Similar to the other states visited in the US, New York is divided into counties, cities, towns, and villages, which are all municipal organisation with their own government that provide most local government services.

Definition of a municipality required approval from the State, with each being granted ranging powers. There are a number of other entities that exist that essentially serve as single purpose local governments, such as school, fire districts as well as development corporations like the Brick City Development Corporation which focuses primarily on economic development for their local government area.

The state of New York has 62 counties which overlay almost 1000 towns and cities. New York City is divided into five boroughs, Manhattan, Brooklyn, Queens, The Bronx, and Staten Island, with a central government authority, the City of New York.

Impacts of climate change poses significant risks to New York City's communities and infrastructure, particularly given the density of population. Hurricane Sandy, which hit New York in 2012, focused attention on the effects that extreme climatic events can have. The New York City Panel on Climate Change (NPCC) is charged with advising the Mayor and the New York City Climate Change Adaptation Task Force on issues related to climate change and adaptation. It produced a set of climate projections specific to New York City in 2013.

The task force concluded that for New York City, by mid-century, mean annual temperatures will increase by between 2.2°C and 3.6°C. Mean annual precipitation has been modelled to increase by between 5 and 10%, and up to 15% at the high end by 2050 and sea levels are predicted to increase between 0.3 and 0.6m, and possibly as high as 0.8m in the same timeframe.

They also predict that; heat waves are likely to become more frequent, more intense, and longer in duration, heavy downpours are very likely to increase in frequency, intensity, and duration and coastal flooding is very likely to increase in frequency, extent, and height as a result of increased sea levels.

PlaNYC, which was discussed at the visit with the City of New York, was released in 2007, and is focused on addressing New York City's long-term challenges including increasing population to 9.1 million by 2030, changing climate conditions, and aging infrastructure. In light of the substantial impact of Hurricane Sandy on New York, the City has also released a plan with actions for both for rebuilding the communities impacted by Sandy and increasing the resilience of infrastructure and buildings citywide. The plan is called "A Stronger, More Resilient New York" and is underpinned by the establishment of a new department to oversee the implementation of the plan. Progress is measured regularly and focused on achievement in key areas including; the Risks We Face; Coastal Protection; Stronger Buildings; Critical Infrastructure & Services and Communities.



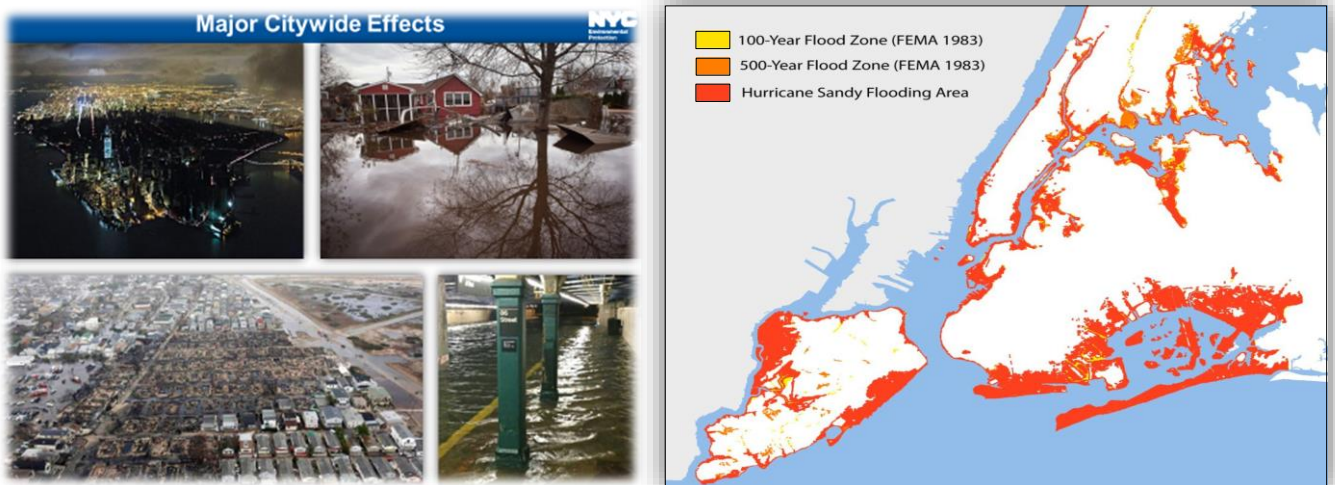


## Observations

New York City (NYC) was impacted by Hurricane Sandy in 2012. Many of the actions currently underway in NYC in relation to climate change adaptation are being implemented in large part as a response to these effects or in preparation for future protection from such events.

Hurricane Sandy was the most destructive of the 2012 hurricane season, as well as one of the costliest ever. It is estimated to have caused about \$75 billion in damage and killed over 285 people. Sandy made landfall in New Jersey, on October 26. However, it caused damage in 24 states in the eastern US.

Hurricane Sandy extended about 280 km from its centre and its highest winds measured about 185kph. At one point, in New York alone, about 2 million people were without power and forced the New York Stock Exchange to close for two days. (Source: Primary facts.com)



The NYC Department of Environmental Protection is proactively planning for climate change, from reducing greenhouse gas emissions to preparing for the impacts of extreme weather to drinking water and wastewater infrastructure. NYC has developed a number of comprehensive planning documents to support their efforts in this regard as highlighted below.



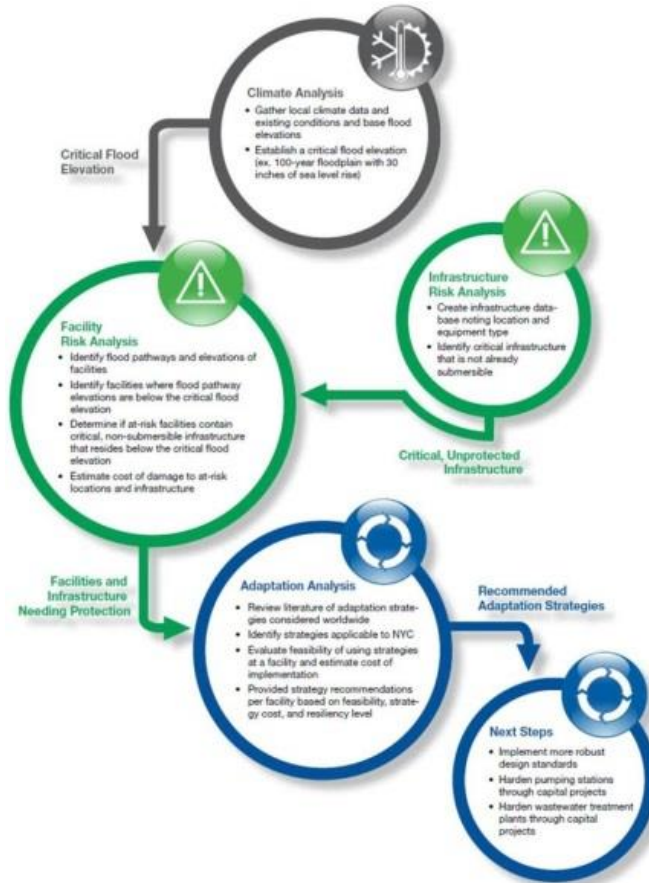
As is the case with many of the cities visited during this tour, NYC has excellent data in relation to the potential impacts of SLR. The chart below compares some of this data to the Hurricane Sandy flood levels. These comparisons give an indication of what SLR impacts would be like on NYC considering the effects of Hurricane Sandy.

**Defining Critical Flood Elevations** **NYC**  
Environmental Protection

| WWTP Name             | Sandy       | FEMA 100-yr ABFE + 30 inches SLR |                       |
|-----------------------|-------------|----------------------------------|-----------------------|
|                       | NAVD88 (ft) | NAVD88 (ft)                      | Local Datum (ft)      |
| 26 <sup>th</sup> Ward | 12.6        | 13.5                             | 12.9 Brooklyn-Sewer   |
| Bowery Bay            | 11.6        | 15.5                             | 13.9 Queens           |
| Coney Island          | 10.1        | 15.5                             | 14.0 Brooklyn-Highway |
| Hunts Point           | 10.2        | 17.5                             | 16.0 Bronx            |
| Jamaica               | None        | 13.5                             | 11.9 Queens           |
| Newtown Creek         | 10.0        | 13.5                             | 12.0 Brooklyn-Highway |
| North River           | 9.7         | 12.5                             | 10.8 Manhattan        |
| Port Richmond         | 12.1        | 14.5                             | 12.4 Staten Island    |
| Oakwood Beach         | 13.1        | 16.5                             | 14.4 Staten Island    |
| Owls Head             | 13.5        | 14.5                             | 13.0 Brooklyn-Highway |
| Red Hook              | 11.7        | 14.5                             | 13.0 Brooklyn-Highway |
| Rockaway              | 11.4        | 14.5                             | 12.9 Queens           |
| Tallman Island        | 10.1        | 15.5                             | 13.9 Queens           |
| Wards Island          | 10.7        | 17.5                             | 15.8 Manhattan        |

11

NYC uses the following process in planning for climate change adaptation. As can be seen it presents an easy to understand process involving assessing impacts, risks and adaptation options and producing adaptation strategies.



## Facilities At-Risk of Storm Surge Inundation



Based on 100-year floodplain plus 30 inches of SLR:

➤ All 14 treatment plants and 60% of pumping stations are at risk.

➤ Over \$1 billion of assets are at risk if no protective measures are implemented.



## Prioritization Approach



Prioritization considered against seven metrics:

1. Historical Frequency of Flooding
  2. Historical Loss of Power
  3. PS Tied in with Other PS (Daisy Chained or Grouped)
  4. Tributary Area Population Impacted
  5. Number of Critical Facilities Impacted
  6. Beaches Impacted
  7. Included in DEP's 10 year Capital Plan
- Operational Metrics (Metrics 1-3)  
 Vulnerability Metrics (Metrics 4-6)  
 Other Metrics (Metric 7)

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In NYC's case the impact on assets from Hurricane Sandy was significant as indicated in the diagram above. In assessing how best to spend its funds it uses a prioritisation process based on 7 metrics as described above.

In addition NYC have identified site-specific protective measures to minimize prolonged service interruption and flood risk, while balancing feasibility, resiliency, and cost. They have also established robust design guidelines for future wastewater infrastructure upgrades/designs that assist in mitigating flood risk.

NYC leveraged post-Sandy storm funds to their optimal effect. In some instances FEMA (Federal Emergency Management Authority) funded up to 100% of damage cost for damaged facilities and in others NYC applied for FEMA funding for damaged or undamaged facilities through a competitive grant process.

In addition NYC had opportunity to apply for funding support through the EPA Storm Mitigation Loan Program Clean Water State Revolving Fund for all other undamaged wastewater facilities. NYC also built additional funding into planned capital projects and changed orders for projects already in design to improve future outcomes in relation to climate change.

NYC outreach programs are outcome based and involve the community at a number of stages of the climate change adaptation process. In particular NYC has a developed a community engagement and support process to resolve local flooding issues.

Of course the success of all of this work will only be measured when another event occurs.





## 2.4 Toronto, Canada

### Overview

Canada's system of government has its origins in the British system and is therefore similar to Australia in number of ways. Canada has three levels of government; federal, provincial and municipal. Canada consists of 10 provinces and 3 territories. At almost 10 million km<sup>2</sup>, Canada is the world's second-largest country by total area. Its border with the United States forms the world's longest land border.

Provinces have more autonomy than territories, having responsibility for social programs such as health care, education, and welfare. Provincial Government also has responsibility for highways and provides a contribution to local government for the maintenance of major regional roads

Ontario is one of the ten provinces of Canada. It is Canada's most populous province, accounting for nearly 40% of all Canadians. It is home to the nation's capital city, Ottawa, and the nation's most populous city, Toronto. Most of Ontario's 2,700km border with the United States follows inland waterways.

Toronto is located on the north western shore of Lake Ontario. The city has a population of over 2.6 million residents. The greater Toronto area has a population in excess of 6 million.

There are about 3,700 municipal governments in Canada. As in Australia municipal government is not recognised in the Constitution but may be established by provincial/territorial authorities.

Local Government operates under the framework of the Provincial Local Government Act. Local Government provides similar services to those provided by local government here in Victoria with the addition of police and fire services. Water supply and sewerage are generally managed on a regional basis, with local government taking responsibility for the reticulated systems within their respective municipality. Local Government income is largely drawn from property taxes (rates), Provincial Government grants and development fees.

Municipal governments are, in effect, subdivisions of their province. While the municipality has autonomy on most decisions, all by-laws passed by that municipal government are subject to change by the provincial government at any time.

In some provinces, several municipalities in a particular area are also part of an upper tier of municipal government, which provides more regionally-oriented services. Depending on the province, this second tier may be called a county, regional municipality, regional district or regional county municipality. Ontario has 444 municipalities. As best I can tell about 30 of these are considered "upper-tier" regional councils, and about 414 are what would be considered as local councils.

Similar to the United States, some areas in Canada are unincorporated, with no municipal government at all. Government services in an unincorporated area are provided either by a local agency, or by the province itself.

In Canada, 83% of the municipal government revenue is raised through their own sources, the majority of which comes from property taxes. Additional funding sources include the sales of goods and services and fines.

In 2011 the Canadian federal government provided almost \$150M over 5 years to support its adaptation programs. The aim of this funding was to provide credible, scientifically-sound information to support adaptation planning and decision-making. At the same time, the Federal





Adaptation Policy Framework was developed to help guide federal priorities to address future climate risks. The funding provided support for a range of actions, including Environment Canada's Climate Change Prediction and Scenarios Program and Transport Canada's Northern Transportation Adaptation Initiative.

Like many areas around the world, and in particular some of the sites visited during this tour, climate change has already become a reality in Ontario with a number of extreme weather events happening in recent years including major flooding and ice storms.

### Observations

Our visit to Toronto included a joint visit to the Region of Halton / City of Burlington and the City of Toronto (which consisted essentially of a bike tour of cycling infrastructure in Toronto City). Given this I have been able to make some observations regarding climate change adaptation planning from the City of Toronto's website amongst others. Climate Change adaptation planning at the Region of Halton / City of Burlington was in its early stages and as such has not factored significantly in this report.

The City of Toronto's has developed a Climate Change Action Plan that was followed by the development of a Climate Adaptation Strategy, Ahead of the Storm: Preparing Toronto for Climate Change, which outlined a number of actions that will improve the City's resilience to climate change and extreme weather events.

Subsequently, the City developed two reports focused on improving the City's resiliency, Resilient City: Preparing for Extreme Weather Events and Resilient City: Preparing for a Changing Climate.

The City of Toronto developed its own climate change risk assessment tool (process and software). The tool allows for service and infrastructure providers to identify and mitigate climate change-related risks and take action to reduce the impact of severe weather on infrastructure and key services.

Climate change risk assessments have been conducted in two City divisions: Transportation Services and Shelter, Support & Housing Administration. Other divisions will follow. A Resilient City Working Group has been formed to facilitate this process.

The City, residents and businesses are taking progressing a number of actions to make infrastructure more resilient to extreme weather and improve the city's overall sustainability, including:

- Planting more trees to increase shade and to clean and cool the air
- Increasing the size of storm drains and culverts to handle greater volumes of runoff
- Using rain barrels to reduce runoff and capture rainwater for reuse
- Installing permeable surfaces to reduce runoff from heavy rainfalls
- Landscaping with drought-resistant plants
- Using cool/reflective materials on the roofs of homes and buildings to reduce the urban heat island effect

As expected, climate change in Canada is not uniform. Northern regions of the country are feeling the most severe impacts, with warmer temperatures melting permafrost, changing the distribution of plant and animal life, and melting sea-ice.

In southern Canada, surface temperatures have warmed by 0.5 to 1.5°C during the past century. Precipitation on average has increased by up to 35% since 1950 and annual snowfall has been significantly decreasing during the same period.



Summers in Toronto are heating up. The summer of 2005 began with the warmest June on record, with the warmth continuing into July, August and September. There were 37 days with maximum temperatures greater than 30°C compared to an average of 13 most years. This trend of is expected to continue and increase in severity.

Canadian climate scientists anticipate average annual precipitation to increase anywhere between 0.5% and 14% in southern Ontario. At the same time there will be an increase in the probability of intense rain events.

Interestingly, warmer air temperatures are predicted to increase surface water evaporation, decrease surface runoff, decrease stream flow, and reduce ice cover formation. As a result, lake water levels are expected to drop throughout the Great Lakes Basin. Climate models predict that Lake Ontario water levels could drop between 8 and 47 cm by 2050.



## 2.5 APWA Congress, Toronto, Canada

The APWA Congress 2014 attended as part of the study tour was an excellent opportunity to get to know new people and hear about a range of issues and initiatives from a new perspective. Many workshops were presented during the conference with a number particularly relevant to my research, including:

**Resilience Is the New Sustainability** - In the wake of recent disasters, recovery and rebuilding efforts are increasingly focused on the link between disaster resiliency and sustainability including robust building standards, infrastructure risk and vulnerability assessments, and economic vitality through secure infrastructure.

**Super Storm Sandy Debris Management - Unprecedented!** - Much of the debris from Hurricane Sandy was blown or washed into the back bays and adjacent waterways creating hazards to navigation, health, environment, and safety that are different than land-based debris fields. The lessons learned from this clean-up will help you plan ahead for potential disasters in your area.

**Public Works Stormwater Summits (Day one and two) Stormwater Resiliency for Public Works –** Included case studies about creating resilient and sustainable infrastructure and systems; and Sustainable Stormwater Management which focused on sustainable stormwater management strategies and best practices.

**Climate Risk Assessment for Adaptation Planning and Implementation Workshop** - Explored current and future climate trends for planning, designing, managing, maintaining, and operating public infrastructure systems and facilities. Real world experiences from a variety of levels provided insight into the importance of recognising climate change as an issue to be incorporated into infrastructure decisions and risk assessment.

I was able to attend many workshops which assisted in consolidating the conclusions and recommendations of this report. It is also worth noting the exceptional quality of the key note speakers at the conference.

Jennifer Keesmaat, Chief Planner, City of Toronto: who presented an “Insight into Toronto: Creating a Place Where People Flourish”.

Chris Hadfield, Former Commander, International Space Station: who gave an excellent presentation on his relatively unique perspective of the “The Sky Is Not The Limit”.

Ian Hill, Public Sector Advocate, Leadership Development Innovator: gave an impassioned “Call to Action: What I’ve Learned About Leadership From The Canadians”.

Alex Steffen, Planetary Futurist, gave an enlightened view on the future and about “Imagining Communities That Can Save the Planet”.



## 2.6 London, England, UK

### Overview

Government in England consists of a Central Government with Local Government operating under either a one tier system - unitary authorities, or a two tier system - county and district councils.

There are five types of local authority in England: county councils, district councils, unitary authorities, metropolitan districts and London boroughs.

County councils cover the whole of the county and provide the majority of public services in their particular area. County councils are responsible for: education, highways, transport planning, passenger transport, social care, libraries, waste disposal and strategic planning.

Each county is divided into several district councils, which may also be called borough councils or city councils if the district has borough or city status. They cover a much smaller area and provide more local services. District councils are responsible for housing, leisure and recreation, environmental health, waste collection, planning applications and local taxation collections.

Many large towns and cities and some small counties are unitary authorities; i.e. they have only one tier of local government. Unitary authorities can be city councils, borough councils, county councils, or district councils and are responsible for education, highways, transport planning, passenger transport, social care, housing, libraries, leisure and recreation, environmental health, waste collection, waste disposal, planning applications, strategic planning and local taxation collection.

Each London borough is a unitary authority and is responsible for the range of services described above. The Greater London Authority (GLA) however provides London-wide government and shares responsibility for certain services such as highways, transport planning, passenger transport and strategic planning.

Some parts of England have a third tier of local government. Town and parish councils are responsible for smaller local services such as parks and community centres.

Local Government income is derived predominantly from Central Government grants, property taxes and developer contributions. Central Government grants provide the majority of Local Government income. There are 353 councils in England.

The UK Climate Change Act 2008 (CCA) provides legislative arrangements about climate change mitigation and adaption. It sets out requirements for the Climate Change Risk Assessment (CCRA) and the UK National Adaptation Programme (NAP).

Following the development of National projections of future changes to the climate in the UK (UK Climate Projections) in 2009, the UK Government published its CCRA in 2012, the first assessment of its kind for the UK. It sets out the main priorities for adaptation in the UK under 5 key themes - Agriculture and Forestry; Business, Industries and Services; Health and Wellbeing; Natural Environment and Buildings and Infrastructure

The NAP that followed in 2013 sets out what government, businesses and the community are doing to adapt to the changing climate. This document will be reviewed every 5 years. A mid programme review will be conducted in July 2015. I will be interested to read this review to understand better the progress of the objectives of the plan, at least in the short term.





An Adaptation Sub Committee was put in place under the CCA to advise government on the preparation of the CCRA, and assess progress on the implementation of the NAP. The committee is made up of experts from the fields of climate change, science and economics.

Alongside the CCRA, 9 Climate Change Partnerships, produce information packs to set out the main risks and opportunities from climate change for different sectors locally.

In addition to these partnerships, a Climate Ready Support Service, led by the Government's Environment Agency, provides advice and support to the public, private and voluntary sectors in relation to information on how the climate of the UK may change, including the UK Climate Projections 2009 and to enable them to adapt to the changing climate.

Further, The Local Government Association's Climate Local initiative provides advice and tools to help build capacity on adaptation among councils.

The Local Adaptation Advisory Panel for England provides advice to central government from a local perspective. It consists of a range of councils and partners from across England, and works to identify and share best practice. The NAP report also contains a 'Cities Commitment' from the 9 largest cities across England.

As shown, over the past 5 years Governments and their partners in the UK have invested substantial time and effort in supporting a unified approach to Climate Adaptation Planning across all sectors.

### Observations



The Greater London Authority is a member of The London Climate Change Partnership (LCCP), a hub for exchange and expertise on climate change adaptation and resilience to extreme weather in London.

### **LONDON** climate change **PARTNERSHIP**

The LCCP are driving forward awareness and action on climate change and is comprised of around 30 public, private and community sector organisations that have a role to play in preparing London for extreme weather today and climate change in the future.

To ensure its success LCCP members must be champions of climate change adaptation within their organisation.

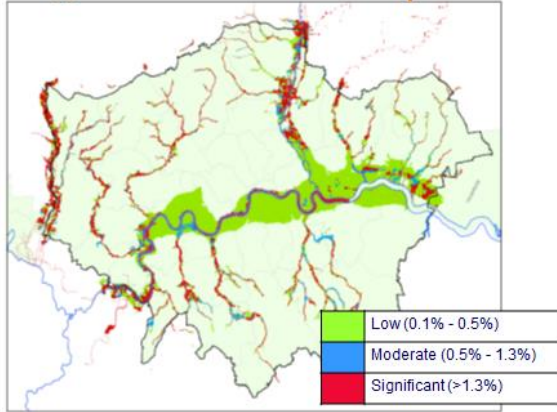
While this partnership has been important to good adaptation planning, so too is the support at the political level of these organisations. From our discussions, this support appears to have waned in recent years but remains critical to the success of long term adaptation planning.

London is particularly vulnerable to a range of climate risks including flooding, overheating, reduced water resources, snow and ice, wind storms and subsidence.

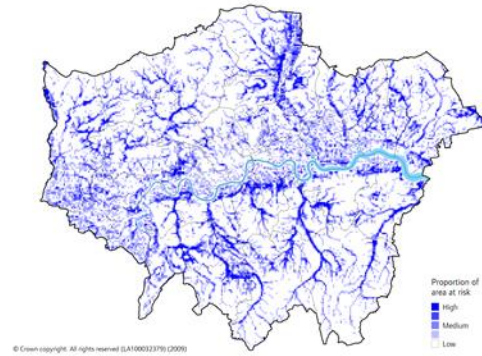
For London, flooding can come from five different sources and often from more than one source; Tidal, Fluvial, Surface, Sewer and Groundwater. As presented in the below diagrams, 15% of London lies on river floodplains with 1.4 million properties being at risk of surface water from an extreme event.



**15% of London lies on river floodplains**



**1.4 million properties at risk of surface water flooding from an 'extreme' event – 140k at high risk**



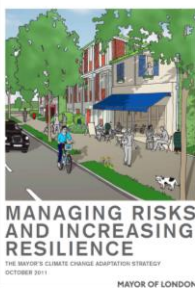
Specifically in relation to Swindon Borough

Council, they expect to see increasing temperatures with summer average temperatures possibly increasing by up to 5 °C by 2080. They also suggest increased seasonality in rainfall, with more rainfall in winter and less in summer on average. Flood magnitude and frequency is also expected to increase, although there is varying uncertainty in future projections.

There have been a number of severe weather events since 2000 that have affected, amongst others, the Greater London Area and Swindon Borough Council;

- Flooding – 2000/2001/2005/2007/2009/2010/2012
- Heatwaves – 2003/2006/2013 – (600 people died in the 2003 heatwave)
- Drought – 2006/2012
- Snow and Ice – 2008/2009/2010

As part of its strategy development, the GLA has taken a risk-based approach to adaptation planning that assesses London’s vulnerabilities to weather-related risks today and uses climate projections to understand how climate change accentuates existing risks or creates new risks / opportunities in the future. It also identifies various risk management options.



The GLA Climate Change Adaptation Strategy contains a range of objectives, including;

- Understanding who and what is at risk, today & tomorrow
- Using spatial planning and development control to ensure new development is fit for the future
- Focusing on ‘win-win’ multi-functional solutions
- Raising awareness and building capacity
- Ensuring they lead by example
- Researching the ‘adaptation gap’ and ‘adaptation pathways’.

An example of some of the work being done by the LCCP was presented during our visit with representatives of the partnership. The partnership has developed a business case for adaptation measures to be included in housing retrofits. Direct impacts such as building damage from flooding, and indirect impacts, such as damage to residents’ health from stress or extreme temperatures, are here to stay, and they are set to increase as a result of climate change. Combining adaptation outcomes early as part of renovations or retrofits will have both economic and social benefit when compared with the future costs of implementing these works or recovering from the damage.



The chart below was presented as part of this business case to represent the benefits of including adaptation measures into retrofits.



## Conclusions/Recommendations

Let me conclude this report where it began. The following quote was presented at one of our meetings with Miami Dade County in Florida.

*“When we build let us think we build forever. Let it not be for present delight nor for present use alone. Let it be such work that our descendants will thank us for, and let us think, as we lay stone upon stone, that a time is to come when these stones will be held sacred because our hands have touched them, and that men will say, as they look upon the labor and wrought substance of them, “See! This our fathers did for us.”*”

It has set the scene for this report and continues to be a point of consternation in my mind as I prepare to write my conclusions and recommendations. I suggest that the reason for this is that while engineers on the whole would agree with the statement, putting it into practice in terms of climate change adaptation has many challenges, not the least of which is relates to strong leadership. For without this strong leadership and support on such a significant global issue, I suggest for many organisations, we will simply “tread water”, so to speak until the impacts felt by our communities are so significant we have no choice but to intervene, regardless of the form the intervention takes.

Having said that there are many things that all local governments should consider in the short to medium term to better prepare themselves for climate change impacts.

In terms of leadership, as with the overseas experience, there are many regional groups that have been initiated to examine and advocate for improved climate change knowledge and outcomes. In Gippsland, under the Victorian Adaptation Sustainability Partnership, Wellington is part of the group investigating opportunities to integrate climatic impacts into local government process. I think it is incumbent on all local governments, particularly those that are highly vulnerable to the impacts of climate change to join or become more involved in these partnerships or to initiate them where they don't exist. There were many excellent examples of highly effective partnerships during our travels. The standout for me was the South East Florida Climate Change Compact. The important aspect for this compact is that it was initiated at the highest levels of the organisations that formed the Compact, it is well resourced, and has buy in from each of the partners within the Compact. My recommendation is therefore, that, if they haven't already, Councils that are vulnerable to the impacts of climate change find themselves a point of connection within their area or with similarly impacted Councils, and commit, not only to the conversation but to meaningful outcomes. This will set the foundation for all that comes beyond this point.

In terms of the science of climate change and data, my general observation earlier in this report that the “science is in” is accurate when it comes to global understanding and impact. While there is inherent variability on the scale of the impact, which was the case for every site we visited, on the most part, each Council had, or was acquiring site specific data to more accurately understand impacts at a community level. The consensus view was that it is critical to be able show communities how global predictions translate into to local impacts. This is an important element to harness improved understanding during the community engagement process. There were a number of good examples of data gathering and presentation shown during our visits, a number of which are presented in this report. My recommendation is therefore, that data continues to be gathered at the National, State and Local levels to enable these predictions to be more accurately represented at the local level.

We saw a number of excellent and well developed climate change adaptation processes during our tour. As you would expect, they generally accounted for key themes including data gathering, impact analysis, risk assessment and engagement. At the end of the day, I suggest it's up to each Council to assess which specific process suits their environment the best. I have presented a number of these within this report. At the core of each process we saw was a risk assessment and





action prioritisation process. Given that there is a new Australian Standard for dealing with the management of risks associated with climate change for infrastructure, my recommendation would be that for consistency, Councils use this as the basis for climate change risk assessment. Having consistency during the risk assessment process through the use of this standard should ensure that solutions promoted on regional level are easily comparable, particularly if when looking for external funding to support any actions.

Which leads me onto funding and resourcing. On the whole, the organisations visited during this tour were large councils, certainly when compared to Wellington Shire. Having said that, they are challenged with the same issues when it comes to resourcing and funding climate change adaptation actions, albeit on a larger scale. The standout exception to this was of course in New York City where, in the aftermath of Hurricane Sandy, the City received substantial funding from the Federal Government for its infrastructure recovery a preparedness program. While not the preferred outcome to fund adaptation outcomes, the New York City example shows how important it is take a considered and planned approach to asset restoration, particularly with regard to building future resilience into infrastructure so as to avoid the same impacts occurring again. New York City was able to leverage recovery funding in addition to other funds to restore its damaged infrastructure to adapt to future climatic conditions.

Communities play a crucial role in how Councils respond to the impacts of climate change. For some, these responses are simple and easily achievable, for others, they are well beyond the means of the community or the local authority. The important aspect in terms of community engagement is to involve the community from the beginning of the planning process. During our tour, it was clear that those who have involved the community early are progressing well with their planning process. So my recommendation is for Councils to consider including climate change impacts and adaptation into regular community engagement programs.

Local governments are critical to good climate change adaptation and many of the Councils we visited are clear leaders in this regard. Local governments are the primary land use planning agencies and are often amongst the first responders to extreme events such as floods and fires. Local government planning, resource allocation and coordination are essential to reduce the risks and impacts of climate change.

The effects of climate change pose significant risks for local authorities. Climate change will result in more frequent and more intense rainfall and weather events, increased temperatures, and increased sea levels amongst others. This will cost billions of dollars in recovery and restoration costs associated with extreme events. These impacts have the potential to be hugely disruptive to how local governments operate.

Infrastructure investment decisions have enormous impacts on our vulnerability to climate change and the costs of climate impacts. Adapting to the challenges posed by climate change is one of the key issues faced by our communities in the 21<sup>st</sup> century. By adjusting our thinking, decisions and actions in response to observed or predicted changes in climate, we will be able to better plan and implement optimal outcomes for the greater benefit of all concerned.



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<http://climatelondon.org.uk>



## Appendices

### Appendix 1 – Itinerary of site visits

|                              |                 |   |
|------------------------------|-----------------|---|
| Monday, 4<br>August 2014     | <b>9:00 AM</b>  | <b>San Francisco Public Utilities Commission</b>              |
|                              | <b>1:00 PM</b>  | <b>County of San Mateo</b>                                    |
| Tuesday, 5<br>August 2014    | <b>9:00 AM</b>  | <b>Alameda County Public Works Agency</b>                     |
|                              | <b>2:00 PM</b>  | <b>San Francisco Municipal Transport Authority</b>            |
| Thursday, 7<br>August 2014   | <b>9:30 AM</b>  | <b>Miami-Dade County – Public Works</b>                       |
|                              | <b>1:15 PM</b>  | <b>Miami-Dade County – Office of Sustainability</b>           |
|                              | <b>3:00 PM</b>  | <b>Miami-Dade County – Environmental Resource Management</b>  |
| Friday, 8<br>August 2014     | <b>8:45 AM</b>  | <b>City of Miami Beach</b>                                    |
|                              | <b>3:30 PM</b>  | <b>Miami-Dade County – Parks and Recreation</b>               |
| Monday, 11<br>August 2014    | <b>1:00 PM</b>  | <b>City of Newark - Brick City Development Corporation</b>    |
| Tuesday, 12<br>August 2014   | <b>10:00 AM</b> | <b>New York City - Department of Transport</b>                |
|                              | <b>1:15 PM</b>  | <b>New York City - Department of Environmental Protection</b> |
| Thursday, 14<br>August 2014  | <b>9:30 AM</b>  | <b>Region of Halton</b>                                       |
|                              | <b>1:00 PM</b>  | <b>City of Burlington</b>                                     |
| Friday, 15<br>August 2014    | <b>9:00 AM</b>  | <b>City of Toronto</b>  |
|                              | <b>2:00 PM</b>  | <b>Thales</b>   |
| Sunday, 17<br>August 2014    |                 | <b>APWA Conference - Day 1</b>                                |
| Monday, 18<br>August 2014    |                 | <b>APWA Conference - Day 1</b>                                |
| Tuesday, 19<br>August 2014   |                 | <b>APWA Conference - Day 1</b>                                |
| Wednesday, 20<br>August 2014 |                 | <b>APWA Conference - Day 1</b>                                |
| Friday, 22<br>August 2014    | <b>9:00 AM</b>  | <b>City of London</b>   |
|                              | <b>1:00 PM</b>  | <b>Greater London Authority</b>                               |
|                              | <b>3:00 PM</b>  | <b>Transport for London</b>                                   |
| Tuesday, 26<br>August 2014   | <b>9:30 AM</b>  | <b>Swindon Borough Council</b>                                |

